Barcelona Supercomputing Center
Centro Nacional de Supercomputación

imprex
Learn from today to anticipate tomorrow

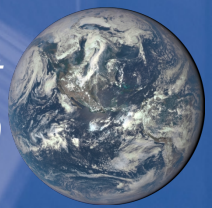
Can dynamical seasonal forecast be useful?

Chloé Prodhomme, Andrej Ceglar, Marco Turco, Niti Mishra

Joint research center, Ispra, 28/06/2016

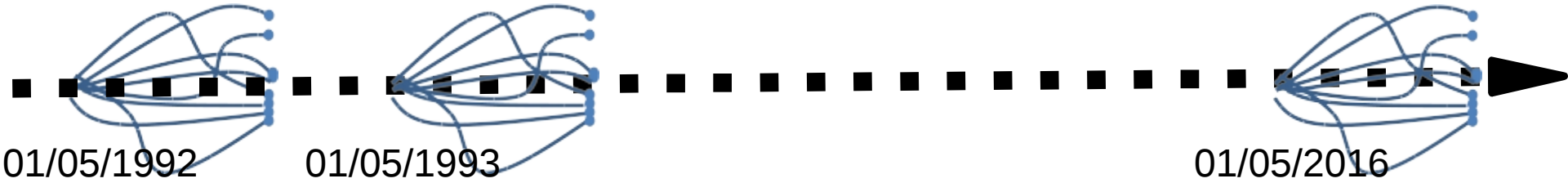
SPECS
Seasonal-to-decadal climate Prediction for the improvement of European Climate Services

Earth Department
Climate Prediction Group



Dynamical seasonal climate forecast

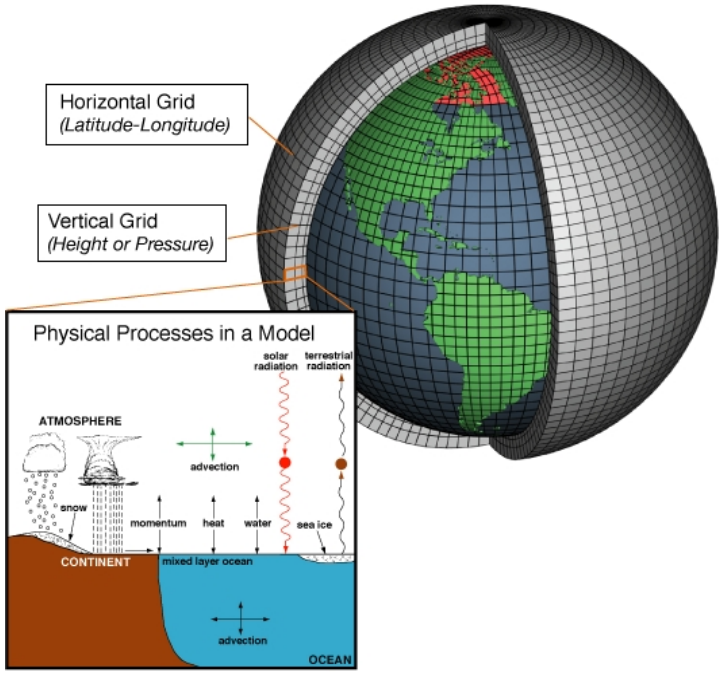
Atmosphere reanalysis



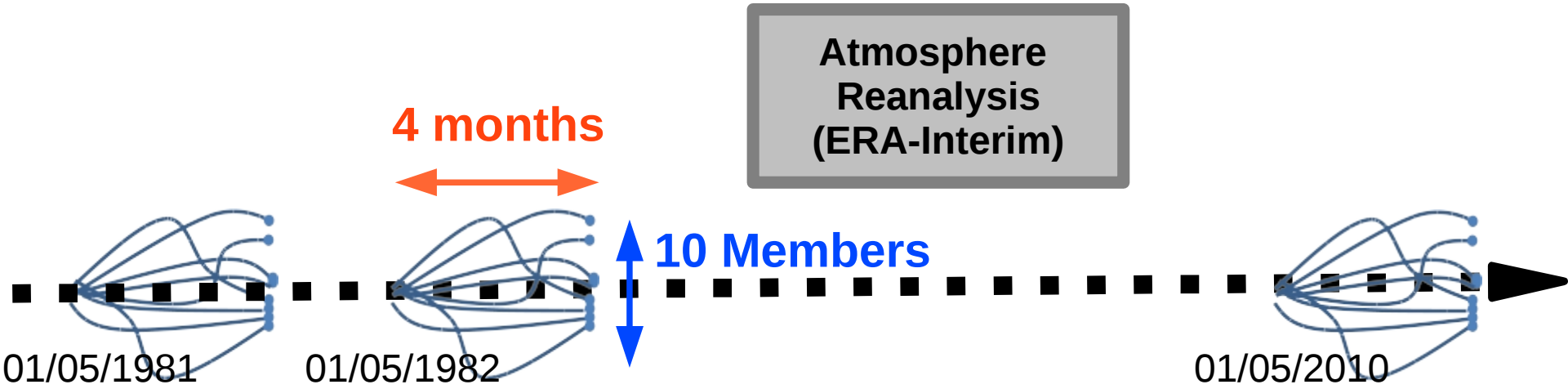
Land reanalysis

Ice reanalysis

Ocean reanalysis



The EC-Earth forecast system

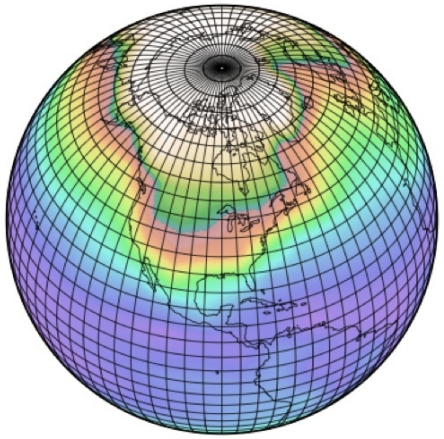


Land reanalysis (ERA-Land)

Ice Reanalysis (IC3/BSC)

Ocean reanalysis (ECMWF S4)

EC-Earth 2.3 coupled model



Experimental setup: Land initialization

Atmosphere Reanalysis (ERA-Interim)

4 months

10 Members

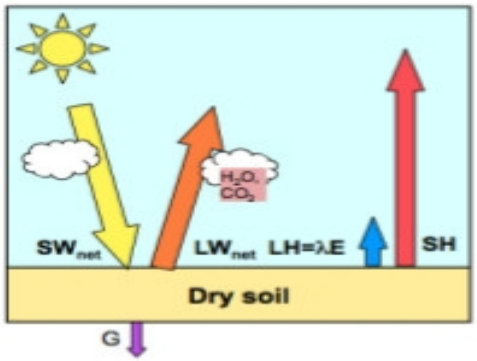
01/05/1981 01/05/1982 01/05/2010

?

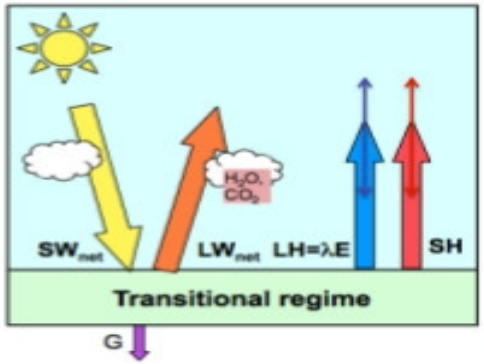
Land reanalysis (ERA-Land)

Land reanalysis (ERA-Land climatology)

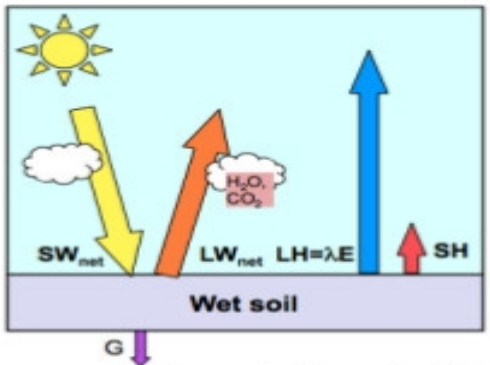
Dry climate regime



Transitional climate regime



Wet climate regime

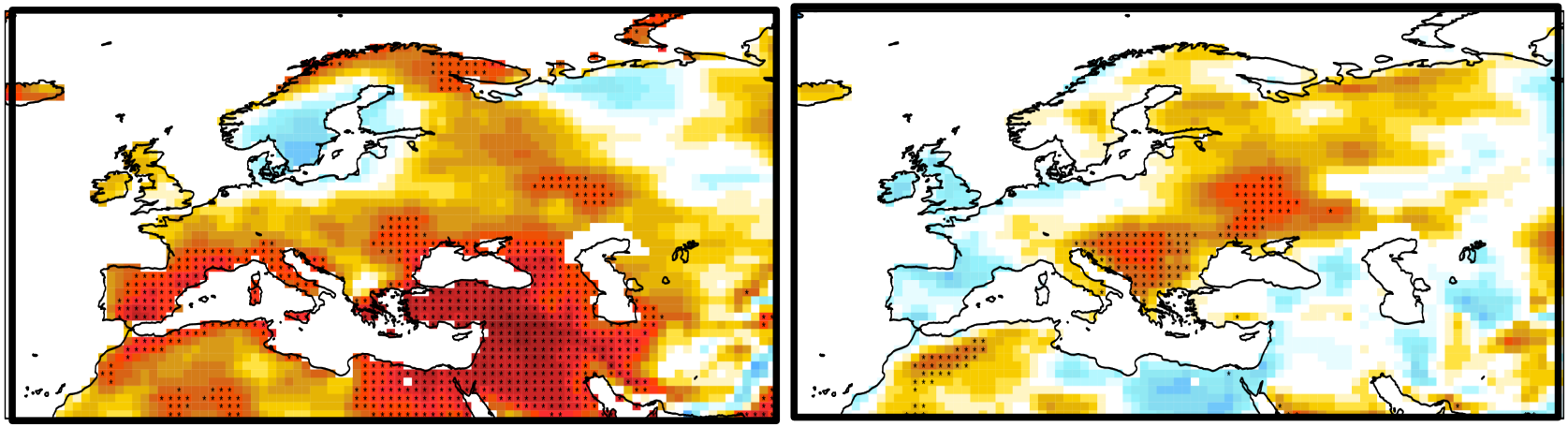


Result on precipitation and temperature

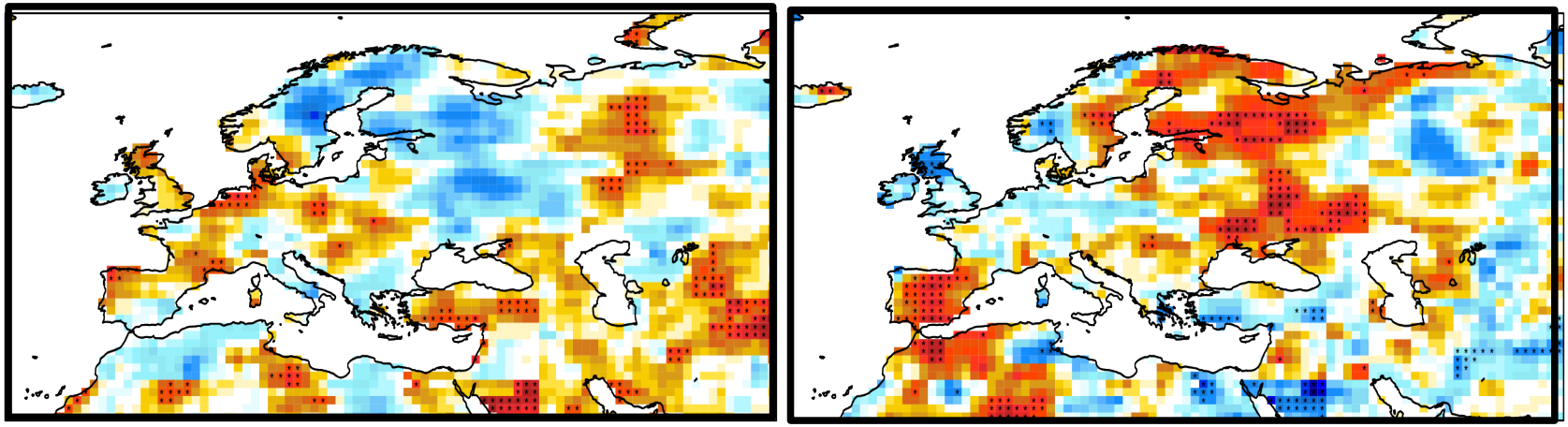
CLIM **INIT-CLIM**

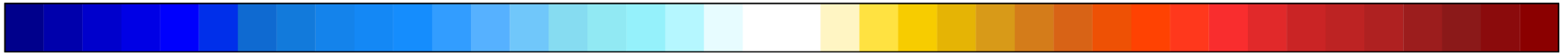
Prodhomme et al. 2015

2m-temperature



Precipitation

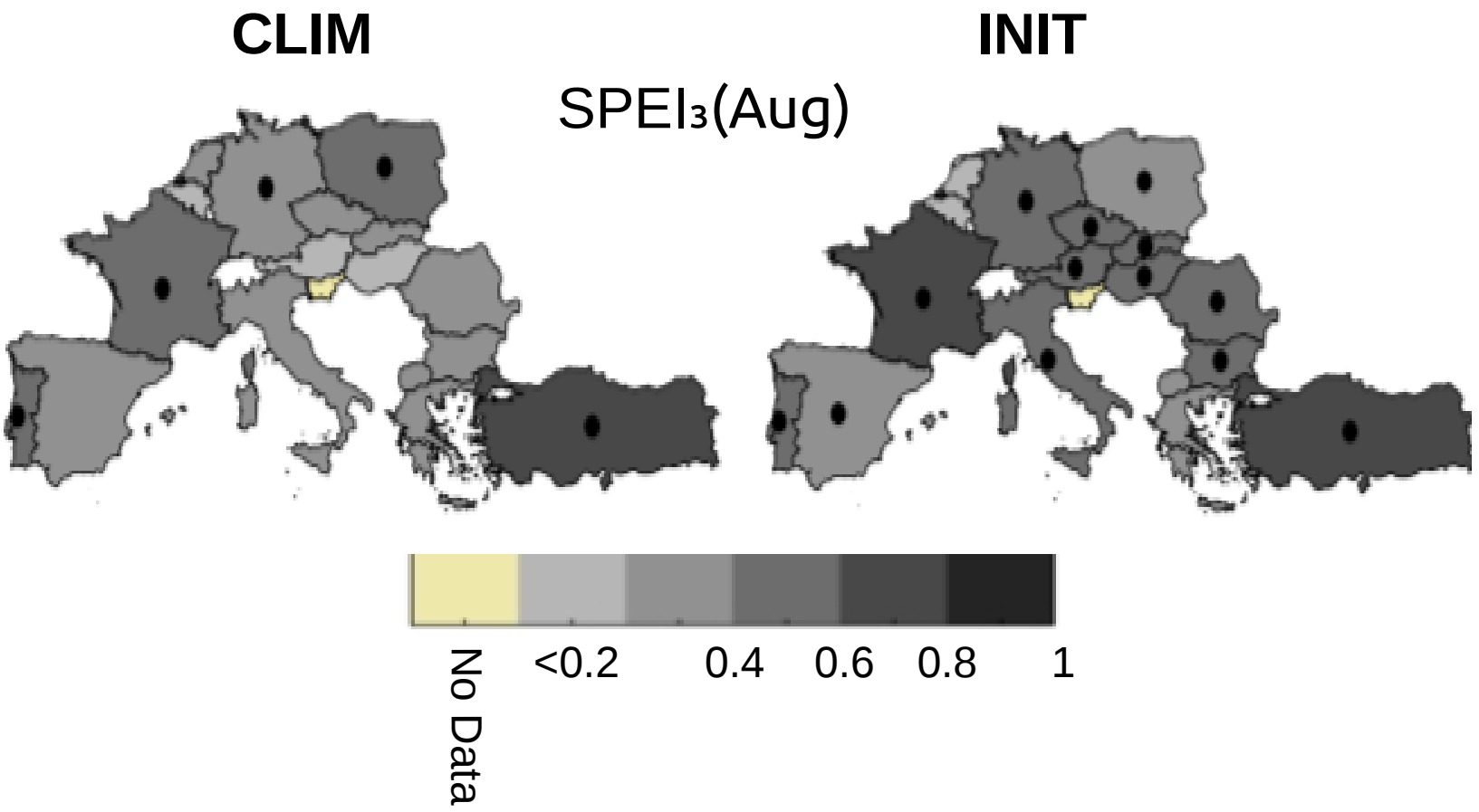




1 0 -1

Impact on drought prediction

SPEI: Calculated through a non parametric approach based on *Hao and Aghakouchak et al. (2013)*



Courtesy to Marco Turco and Andrej Ceglar

Application on agriculture: Grain maize yield

For each European Country:

$$\text{Yield}(t) = a + b \cdot \text{Trend} + c \cdot \text{Trend}^2 + d \cdot \text{DrougthIndex}(t) + \varepsilon(t)$$

SPEI

The procedure to develop this MLR model consists in several steps:

- Normalize the Yields (i.e. Y = log(yields)).
- Standardize both the yields and predictors series.
- Test several drought index: SPEIn (m), where m indicates the final month of accumulation of the SPEI index (June, July or August) and n indicates the different accumulation periods.
- For each country and drought indicators, we develop the MLR. Significance of the coefficient estimated with a boostrap.
- Calculate the correlation between simulated and observed series and keep the best model that one that shows the highest correlations (in out-of-sample conditions).

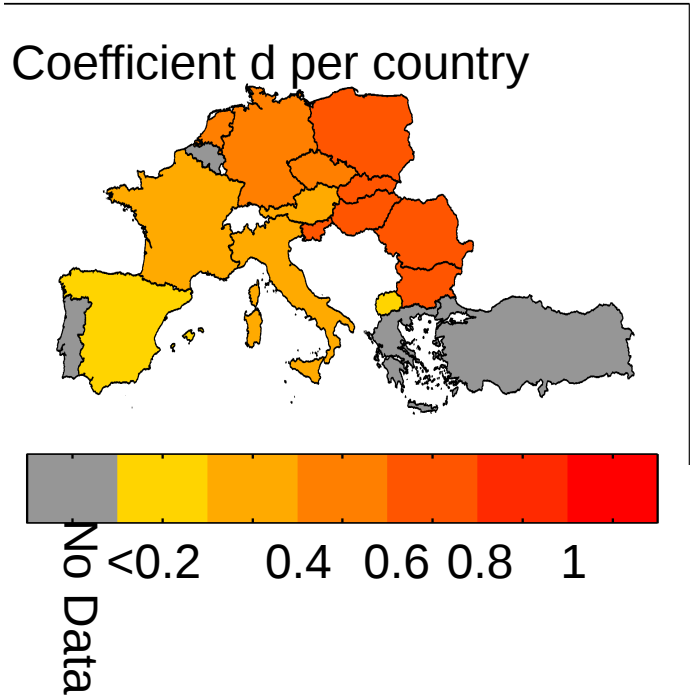
Courtesy to Marco Turco and Andrej Ceglar

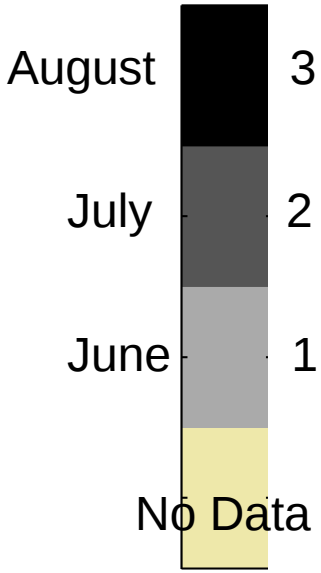
The regression model

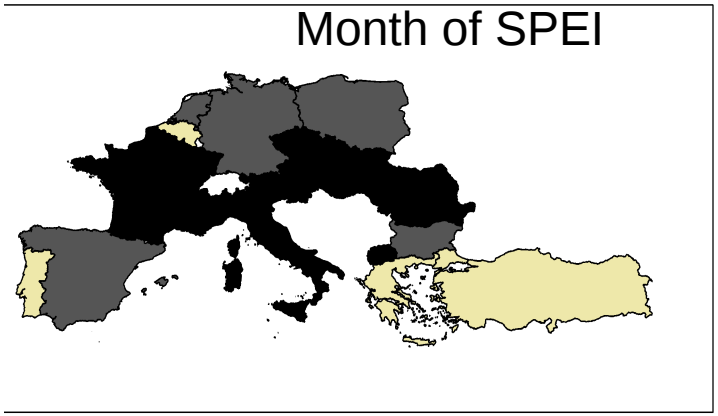
For each European Country:

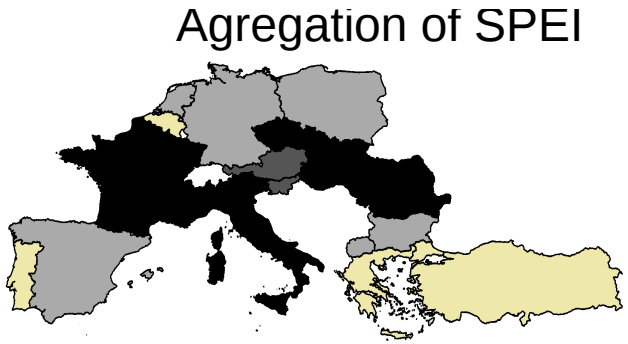
$$\text{Yield}(t) = a + b \cdot \text{Trend} + c \cdot \text{Trend}^2 + d \cdot \text{DrougthIndex}(t) + \varepsilon(t)$$

$\text{SPEI}_1(\text{June}) \ldots \text{SPEI}_3(\text{Aug})$









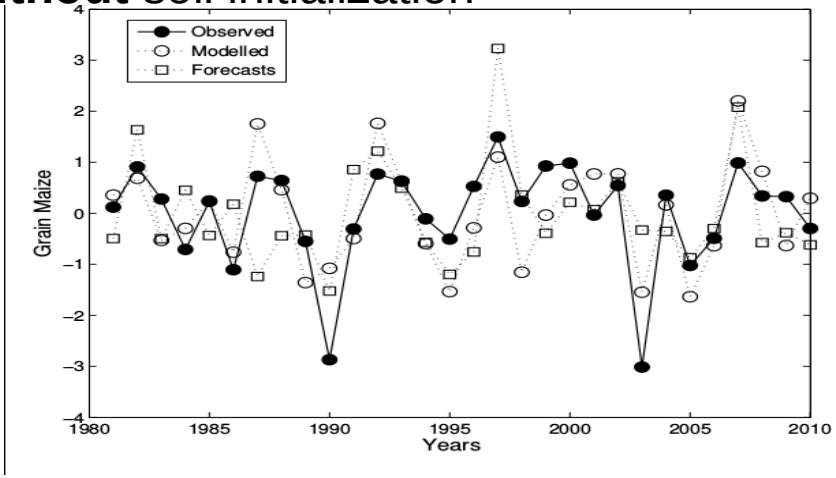
Courtesy to Marco Turco and Andrej Ceglar

Grain maize yield prediction

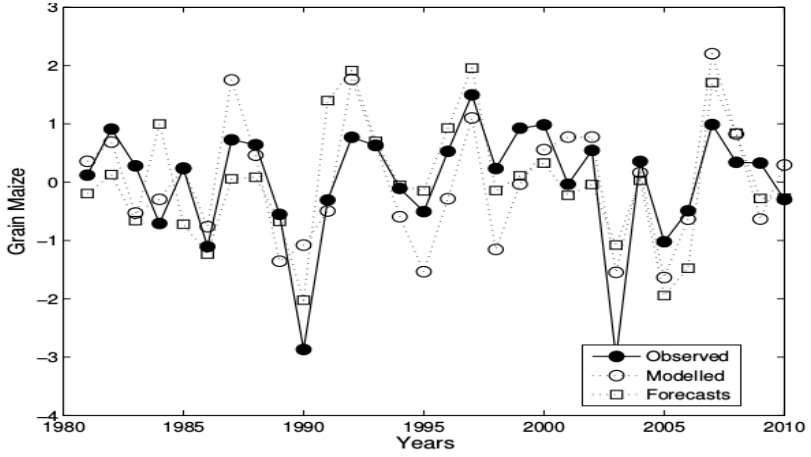
Correlation **without** soil initialization

Correlation **with** soil initialization

Time serie over France **without** soil initialization



Time serie over France **with** soil initialization



Courtesy to Marco Turco and Andrej Ceglar

EUROSIP Data base

- ECMWF S4

51 Members for May and November start date. 15 otherwise.
Atm: IFS 36r4 ~70km
Ocean: NEMO ~100km

- MeteoFrance S4

8 members

We assess the skill using all the members available over the common period **1992-2012**

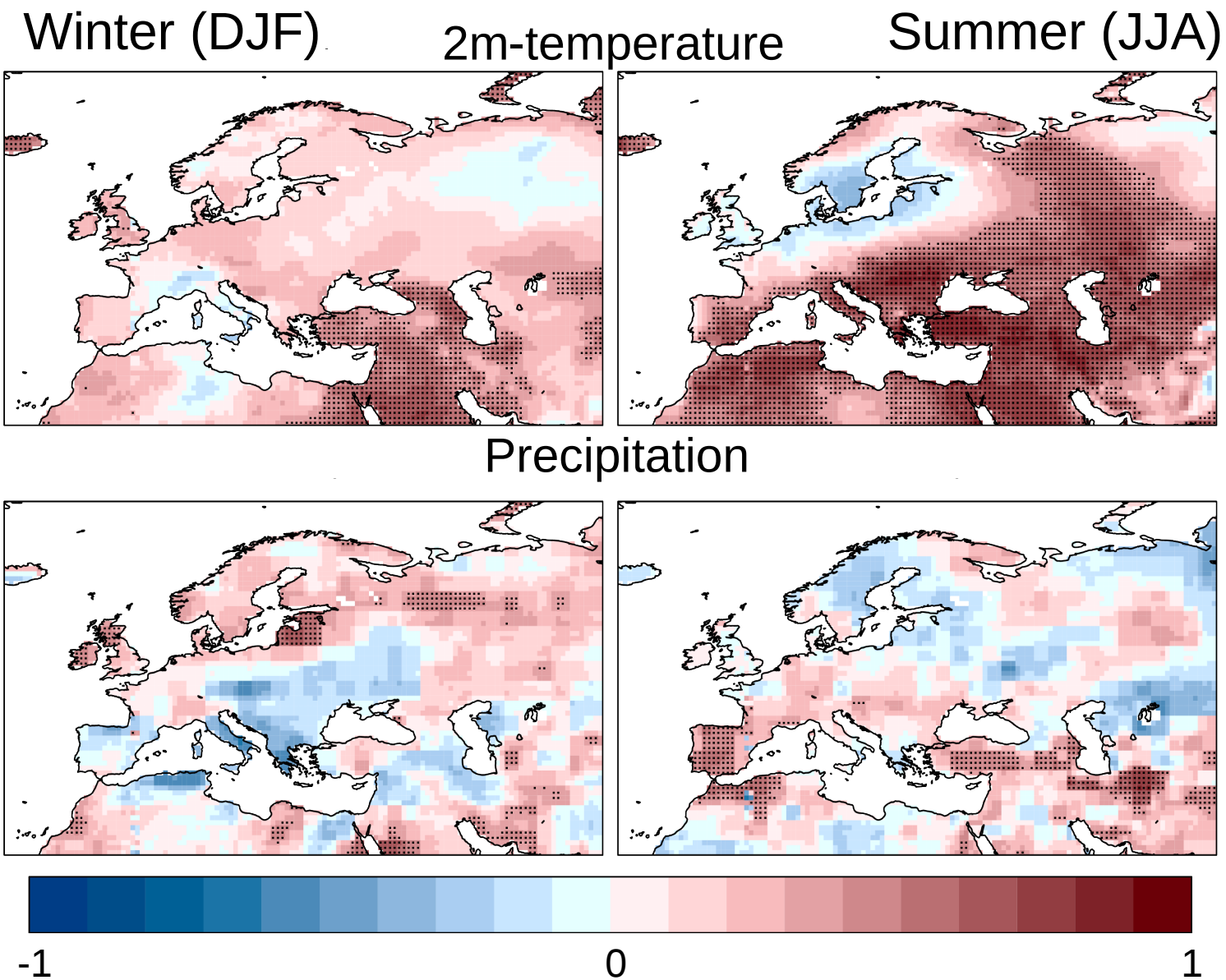
- GloSea5

24 members generated 1 day moving start dates
Atm: HadGEM3 ~50km
Ocean: NEMO ~25km

- CFSv2

24 members

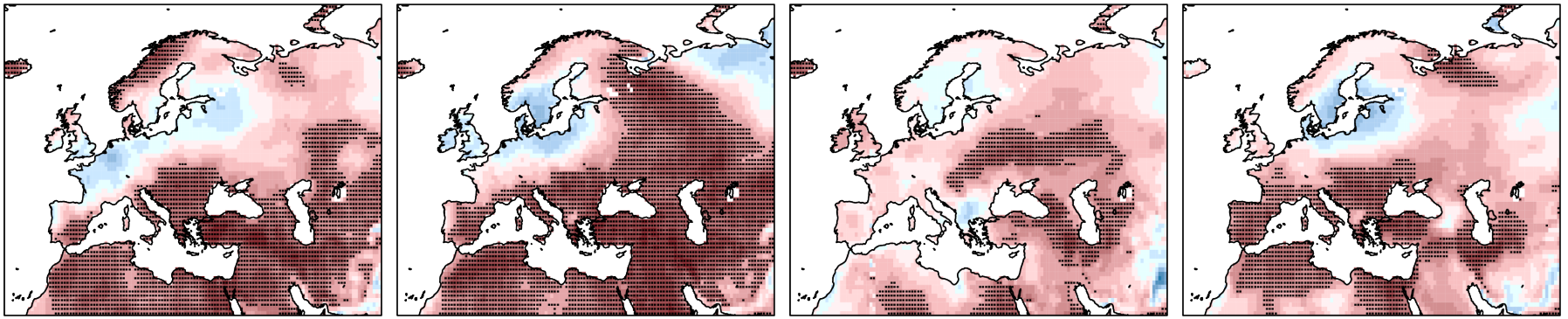
Skill of the Multi-Model Mean



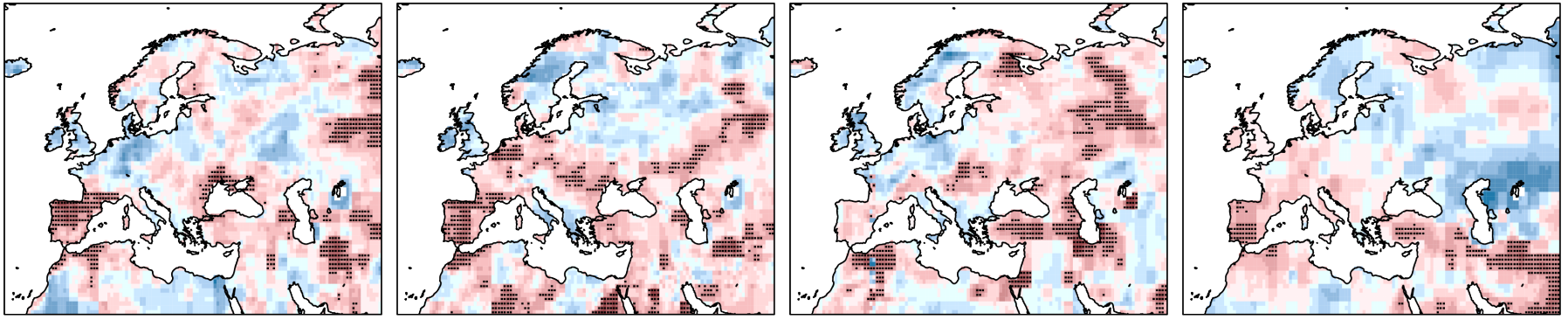
Skill of individual system

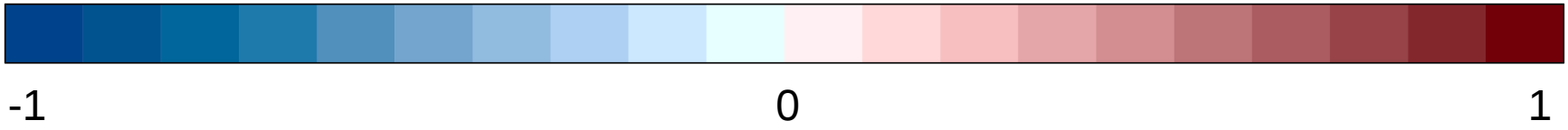
2m-temperature

GloSea5 **ECMWF** **NCEP** **MeteoFrance**



Precipitation



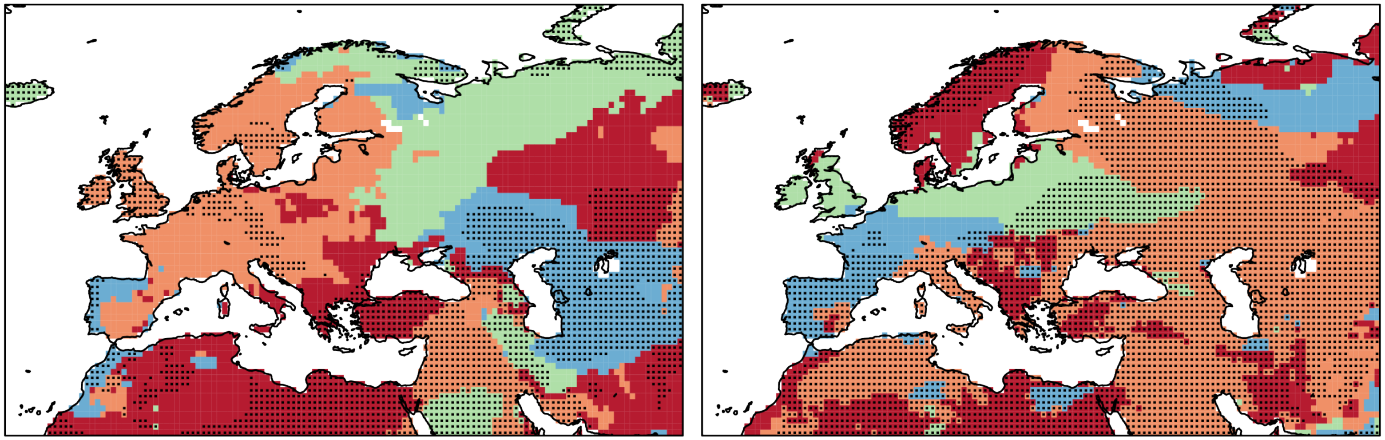


How to choose the more adequate system

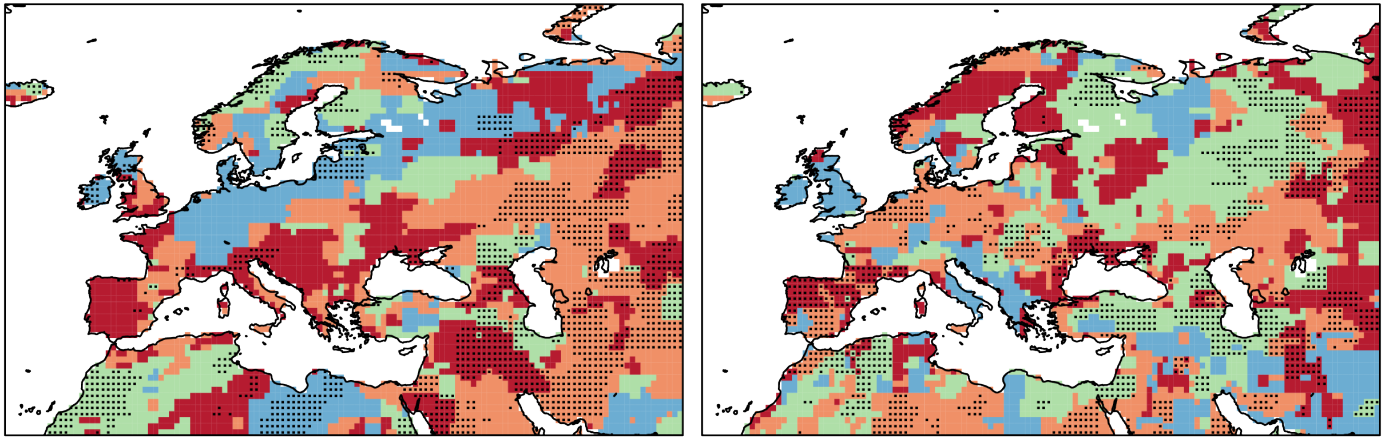
Winter (DJF)

2m-temperature

Summer (JJA)



Precipitation



Glosea5 ECMWF NCEP MF

Summary and conclusion

→ Seasonal forecast exhibits limited skill over Europe in particular for precipitation.

→ Land surface initialization improves the skill over Europe of temperature, precipitation and drought index.

→ Using a MLR based on drought index with dynamical seasonal forecast allow to predict the grain maize yield 3 month ahead.

→ Choosing the correct forecast for your purpose is essential (region, season and variables). It might exist a “window of opportunity” for your specific purpose.

Prospects

→ Include more parameters into the grain maize forecast (heat wave)

→ Make an *exhaustive* assessement of the EUROSIP system.

→ Share data and collaborate!

www.bsc.es

Barcelona Supercomputing Center
Centro Nacional de Supercomputación

Thank you!

For further information please contact

Chloe.prodhomme@bsc.es
andrej.ceglar@jrc.ec.europa.eu
Marco.Turco@bsc.es